Lunar Airborne Dust Toxicity Advisory Group (LADTAG)

Consensus Opinions and Recommendations

15 September 2005

RISK ASSESSMENT:

The risk assessment framework for the lunar dust problem is as follows:

Dust Sources → Human Exposures → Potential Health Effects

RANGE OF SAFE EXPOSURE ESTIMATES:

Various opinions within the group place the range for 6 months of episodic, safe exposure between 0.01 mg/m^3 and 3 mg/m^3 for respirable dust (<10 um), time weighted average.

Short term exposure limits (1 hour) that protect the crew from any acute effects seem to lie in the range of 0.5 mg/m^3 to 10 mg/m^3 for respirable dust.

At this point these ranges should not be in any way considered a standard for human exposures until the uncertainties are reduced. Those uncertainties can be reduced by scientific investigations. The initial step in the investigations is to agree to a general set of sketch plans to guide each investigation.

A sketch plan is a 2-3 page summary of the significance of the issue, the literature pertaining to the issue, and a top-level plan outlining the experiments that need to be done. The lead for each plan is indicated below with an asterisk.*

SOURCE → EXPOSURE:

The experiments or information that will allow us to reduce the size of these ranges associated with source to exposure in the habitat are as follows:

1) Create activated simulant and/or lunar dust and characterize their passivation in a life support habitat. Sketch Plan: Carter, McClusky*, Stubbs, Chen.

2) Review data on lunar dust with size <10 um for surface area, mineralogy, size distribution, surface morphology, chemistry, electrostatic properties with special attention to differences from earth analogs. Sketch Plan: McKay, Carter*, Stubbs.

3) *In situ* assessment of dust at proposed landing site(s): size distribution, chemical composition, chemical reactivity, and passivation in a habitat atmosphere. Sketch Plan: Jones*, Kerschmann

4) How different is the dust at the south pole compared to lunar dust and simulant samples we have? Sketch Plan: Carter, Schmitt*, Taylor, McKay.

EXPOSURES → POTENTIAL HEALTH EFFECTS:

What can we do to understand the connection between lunar dust exposure and health effects?

1) Review database on human & animal exposures to materials similar to lunar dust: volcanic ash, mineral dusts, and occupational dust exposures. Sketch Plan: McClusky, Lam*, Jones, Baker. The panel notes that acute effects from short term exposures to earth-based mineral dusts are rare. McClusky/Lam to review this area.

2) Review consequences of Apollo astronauts' exposure to lunar dust. Can we look at filters from Apollo capsules and learn anything? Sketch Plan: McKay, Jones, Khan*, Chen.

3) Critical review of existing lunar dust studies to deduce what we can learn. Sketch Plan: James, McClellan*.

4) Conduct in vitro studies of cellular response to simulants and lunar dusts. Sketch Plan: Lam*, Gardner, McClusky.

5) Conduct intratracheal instillation studies of simulants and lunar dusts in one rodent species. Sketch Plan: Lam*, Gardner, Chen, McClusky.

6) Conduct 6 hr inhalation study of simulant and one lunar dust on one rodent species. Sketch Plan: Lam*, Gardner, Chen, McClusky.

7) Conduct subchronic (28-day) inhalation study using stimulant or lunar dust and one rodent species. Sketch Plan: Lam*, McClellan, McClusky.

8) Conduct brief human exposure to activated simulant or lunar dust to assess the acute response of man. This is contingent on the results from 4-7 above.

At this point the panel is only going to sketch the plan for each of the tasks above. We may find that doing some of the tasks above is unnecessary.

NEXT MEETING: February 21-22, 2006 at the Center for Advanced Space Studies in Houston. Sketch plans are due from the leads to their group members 1 month before the next meeting, and the final sketch is due to the Chairman 2 weeks before the meeting.